

Equivalent to WO 93/20015

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TITLE: Forming controlled crack in brittle non-metallic material - by traversing with radiation beam followed by set of fluid coolant

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PATENT-FAMILY:

| PUB-NO | PUB-DATE | LANGUAGE | PAGES | MAIN-IPC |
|----------------------|---------------------------|-----------------|--------------|--------------------|
| WO 9320015 A1 | October 14, 1993 | E | 034 | C03B 033/09 |
| KR 302825 B | December 1, 2001 | N/A | 000 | C03B 033/09 |
| AU 9338984 A | November 8, 1993 | N/A | 000 | N/A |
| EP 633867 A1 | January 18, 1995 | E | 000 | N/A |
| RU 2024441 C1 | December 15, 1994 | N/A | 014 | C03B |
| 033/02 | | | | |
| EP 633867 B1 | August 21, 1996 | E | 019 | N/A |
| DE 69304194 E | September 26, 1996 | N/A | 000 | N/A |
| ES 2092295 T3 | November 16, 1996 | N/A | 000 | N/A |
| JP 08509947 W | October 22, 1996 | N/A | 048 | C03B |
| 033/09 | | | | |
| AU 674677 B | January 9, 1997 | N/A | 000 | N/A |
| US 5609284 A | March 11, 1997 | N/A | 012 | B23K 015/00 |
| JP 3027768 B2 | April 4, 2000 | N/A | 011 | C03B 033/09 |

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ABSTRACTED-PUB-NO: EP 633867B

BASIC-ABSTRACT:

Forming a controlled crack in the surface of a brittle non-metallic material relative along the path of the crack is effected between the material and the impingement zone of a first beam of radiation. The beam is controlled so that the surface is heated to a temp. below the softening pt. of the material. Downstream of that zone a stream of fluid coolant is directed onto the heated surface on the line of the crack. Pref. the impingement zone is elliptical with its longer axis aligned with the crack. At least that region of the body contg. the crack line may be preheated.

After the crack has been formed its depth may be increased by again heating the body along the line of the crack, esp. by a second beam of radiation moving along a track aligned with or parallel to the crack.

Where th crack path is a closed curve, the surface of the body may initially be scored along part of the path, the depth of the score being different at opposite ends; the first radiation beam is initially directed at the deeper end.

USE/ADVANTAGE - For splitting plates of glass and other material; cutting glass for electronics and instrument-making applications; formation of articles with raised decorative edge patterns.

Shape, direction, depth and speed of formulation of the crack are accurately controlled. (Alert reprinted in week 9404)

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ABSTRACTED-PUB-NO: US 5609284A

EQUIVALENT-ABSTRACTS:

A method of separating two portions of a body (1) of brittle non-metallic material from each other by forming a blind crack (4) extending into the body from a surface thereof, and in a desired direction along the surface, including the steps of: effecting relative movement between the body and a target area (2) of the surface at which a beam of radiation is incident on the surface along the intended direction of the crack, and controlling the energy of the

beam so that it heats the surface to a temperature below the softening point of the material, characterised in that a stream of fluid coolant is directed at an area (3) of the heated surface which is on the intended line of crack and which is displaced behind the heated target area by a chosen distance (1), and that the rate of relative movement between the target area and the body (1), the energy of the heating beam, the distance (1) and the thermophysical properties, quantity and conditions of supply of the coolant to the heated zone are all selected so as to achieve a blind crack (4) of a specified depth.

A method of sepg. two portions of a body of brittle non-metallic material from each other including the step of forming a blind crack extending into the body to a given depth from a surface of it, and in an intended direction along the surface, by effecting relative movement at a rate of relative displacement between the body and an elliptical target area on the surface of it, the target area having a transverse minor axis and a longitudinal major axis, and being formed by directing an elliptical beam of coherent radiation towards the surface, the elliptical beam incident on the surface forming a spot, the spot having a major axis aligned along the intended direction of the crack, and controlling the energy of the beam so that the beam heats the surface to a temp. below the softening point of the material while simultaneously directing a stream of fluid coolant at an area of the heated surface which constitutes a cooling zone in the intended direction, the fluid coolant being displaced behind the heated target area by a chosen distance, where the rate of relative displacement between the beam and the body satisfies the equation $V = ka(b+L)/\Delta$, where V is the rate of relative displacement of the beam spot and the body; k is a proportionality factor dependent on the thermophysical properties of the material of the body and a beam power density of the beam; a is the length of the transverse minor axis; b is the length of the longitudinal major axis; L is the distance from the rear edge of the heat beam spot to the from edge of the cooling zone; and Δ is the depth of the blind crack.

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CHOSEN-DRAWING: Dwg.1/6 Dwg.1/6 Dwg.1/6